# agricultural research

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## Ways With Whey

Whey, the ugly duckling of the dairy industry, steadily nears the day when it can take wing as the long-sought swan. For ever since the modern era of dairying, the disposal of this byproduct of the cheesemaker's art, mostly into waterways, has posed serious environmental problems. It was not so before the bulk tank came to the dairy farm; in those simpler times farmers used the whey from their local cheese plant to feed hogs or fertilize fields. Centuries earlier, Samuel Pepys and others across the Atlantic celebrated the drinking of whey as a wholesome beverage at after theatre gatherings. Whey, then, holds a secure, if small, place in our language and culture.

The troublesome side of whey dates from the beginnings of commercial-scale cheesemaking. Agricultural science went to work developing markets for the cheese industry's prodigious output of whey but research-based utilization, while important, was limited. As recently as 1970, for example, after 40 years of research, uses were found for only one-third of about 24 billion pounds of whey produced each year. Since then, however, aided by the industry's response to pollution abatement needs, research has developed markets for 42 percent of all whey now produced.

ARS pioneered utilization research on whey—a substance that is not only edible, but also contains half of the solids of milk and is also rich in vitamins, amino acids, lactose, and soluble protein. Today whey is a valued ingredient in baked goods, confections, frozen and convenience foods, and a host of beverages. Some recent achievements include: a powder blended of whey, soy flour, vegetable oils and nutrients for distribution by AID in developing countries, low-fat spreads, and a sourdough type bread containing vinegar and cottage cheese whey. Many of these advances were based on ARS-developed technology; a new spray-drying method for drying cottage cheese whey, and a method for concentrating whey proteins by ultrafiltration.

Where large quantities of whey are not available for processing, it can be fed to cattle. ARS scientists have devised management practices for the efficient feeding of liquid whey to calves. More recently, they developed whey "lick blocks," similar to salt blocks, which can be placed before calves to replace up to 25 percent of their normal rations. Looking toward the future, research is underway to chemically modify the main component of whey, lactose, for such non-dietary industrial uses as detergents. In time, the inventive and diligent efforts of many researchers will have brought to reality the goal of turning troublesome "wastes" into diverse life-enhancing products.




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COVER: The prototype of a now commercially manufactured ground meat fat analyzer is demonstrated by its co-inventor, Mr. Norris. The analyzer was designed for ground beef and is now being adapted for use on pork, lamb and other ground meats (0274A195–36). Article begins on page 8.

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**Earl L. Butz, Secretary**
**U.S. Department of Agriculture**

**Talcott W. Edminster, Administrator**
**Agricultural Research Service**

# Nitrogen and Sewage

RESEARCH indicates that 80 percent of the nitrogen from secondary sewage effluent can be removed during high-rate soil filtration without using valuable energy sources.

The key to breaking down ammonium and organic nitrogen in the effluent into gaseous nitrogen is flooding sewage basins on a wet-dry cycle, ARS researchers in Phoenix, Ariz., have discovered.

Nitrogen removal from sewage water is important because that element is a big contributor to eutrophication—over enrichment—of lakes and streams. Also, nitrate—the form in which the nitrogen is found after natural processes take place—can get into groundwater supplies. Eutrophication of surface waters causes algal blooms that remove oxygen from the water. Lack of oxygen can contribute to fish kills. Excessive nitrate concentrations in drinking water can cause medical problems such as methemoglobinemia—blue baby disease—in infants.

Soil filtration is a system wherein secondary effluent from a municipal sewage plant is applied to land with sprinklers or in basins allowing it to filter through layers of soil or sand. Depending upon depth of travel and managerial practices, the water is cleansed of most of its "foreign" substances other than soluble salts. Given the right soil conditions, basins can cleanse secondary effluent from almost any size city, depending upon the available acreage, for unrestricted irrigation, recreation, or other use.

The most difficult substance to remove from the effluent is nitrogen. Phosphorus, another large contributor to eutrophication, is found in great supply in secondary effluent but as much as 90

*The Phoenix researchers found that a 9 day wet—5 day dry cycle yielded the best results in breaking down ammonium and organic nitrogen into nitrogen gas. Here, Dr. Lance inspects the infiltration rate of the secondary sewage at a basin during the wet cycle (0474X524-25A).*

*When the basins are dry, nitrification of the ammonium and organic nitrogen material occurs. Nitrification is 98 percent complete when the basin is flooded again; carbon in the newly incoming effluent provides energy for denitrifying the nitrates (0474X526-6).*

percent or more of that may be removed by adsorption to soil particles or by precipitation into the soil profile.

Biological denitrification—breaking down of nitrate by anaerobic bacteria—may be the most desirable process for nitrogen removal because it returns the element to the atmosphere in its natural gaseous form, hence there is no further pollution.

The main difficulty in using denitrification is that most of the nitrogen in sewage is present as ammonium and organic nitrogen which must be biologically oxidized to nitrate by aerobic bacteria — through nitrification — before denitrification can occur.

ARS soil scientists J. Clarence Lance and Frank D. Whisler, Phoenix, Ariz., set up a wet-dry cycle (9 days wet—5 dry) in laboratory soil columns to determine whether both cycles could be accomplished.

Field and laboratory studies show that ammonium is adsorbed on soil particles when the soils were flooded with effluent. Oxygen enters the system when the soil is drained after the wet cycle and the adsorbed ammonium is nitrified to nitrate. Nitrification is 98 percent complete when the lengths of the flooding and drying periods are managed to supply enough oxygen for aerobic bacteria to break down the ammonium stored during the flooded period.

When the soil is flooded again, the incoming sewage water provides carbon—a food energy source for bacteria—for denitrification of the nitrate remaining from the previous flooding cycle. Meanwhile, the ammonium in that sewage water is again being absorbed to the soil.

The ARS team encountered the problem of nitrate build-up in the upper soil layers during the dry cycle when nitrification occurred. When the basin is flooded again, this nitrate is leached to the water table where nitrate pollution can occur. Denitrification is limited at this point because there is not enough carbon to take care of the heavy concentration of nitrate.

Two remedies to this situation were worked out by the Phoenix scientists:

—Allowing effluent to filter into the basin much more slowly than previously would permit carbon in the incoming sewage effluent to be used more effectively by bacteria to break down the layer of nitrate before it reaches the water table.

—Collecting the high-nitrate water after it has reached the groundwater, mixing it with incoming sewage water, and recycling it through the basins would allow denitrification to occur during the flooding cycle.

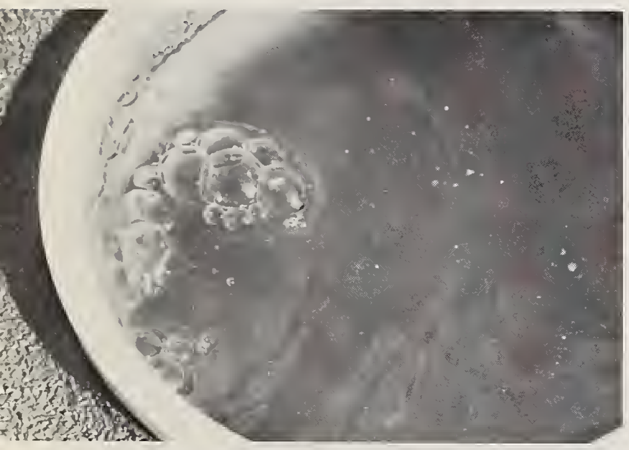
The scientists envision basins with drain tiles at certain depths from where the highly concentrated nitrate water could be pumped back and recycled through the basins. Once the high-nitrate water "front" was depleted, recycling would be discontinued until the next flooding period.

A high-rate land filtration system of about 500 to 750 acres could conceivably remove 80 percent of the nitrogen

from a city sewage treatment plant serving nearly 1 million people. Many other contaminants would be removed by the same treatment.

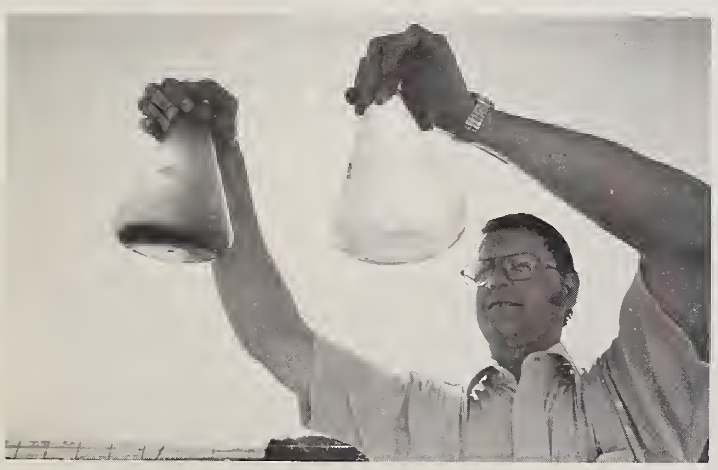
Some cities are employing the denitrification principle in treating sewage; however they are adding methanol—made from natural gas—during the last stage of a three-stage process which does not involve land filtration.

"In these days of energy scarcities, it seems somewhat wasteful to remove carbon during one stage of treatment and add an external energy source in the form of methanol in a later stage," Dr. Lance said. "Furthermore, it may be unwise to establish large-scale waste treatment plants which will accelerate the depletion of energy reserves such as natural gas." □



***Left:*** *Taking in the sun on the Phoenix lab's rooftop, Dr. Lance inspects the tops of the laboratory soil columns. Researchers are using the extended ends of the soil columns to study the effects of different vegetation on the denitrification process (0474X523–18).* ***Above:*** *A close-up of one of the extended soil columns during the wet stage shows nitrogen gas bubbling from the effluent as denitrification takes place (0474X523–14).*

***Above:*** *Laboratory technician Gladys Emery reads a printout from the Technicon Auto Analyzer measuring the parts per million nitrate in a water sample taken from the soil columns (0474X522–21).* ***Left:*** *Laboratory technician James Brooks takes a water sample from the laboratory soil columns to measure the amount of denitrification (0474X525–30A).*



*Dr. Lance holds the beginning and end products of the biological denitrification process in the lab soil columns. The flask on the left contains untreated sewage effluent; the other contains filtered water from near the bottom of the soil columns (0474X523–20A).*

*Laboratory technician A. J. Martinez treats cotton pplants with virus to control such insects as pink bollworm and tobacco budworm. On other crops, the virus has helped control such pests as the beet armyworm and the cabbage looper (0374X284–13).*

# Tissue Cultures in Insect Control

TISSUE CULTURES—long employed in the study of human diseases—are now aiding entomologists in their studies of viral disease of insect pests.

The studies are part of a continuing ARS program to find safe and effective pest control methods that pose no threat to the environment.

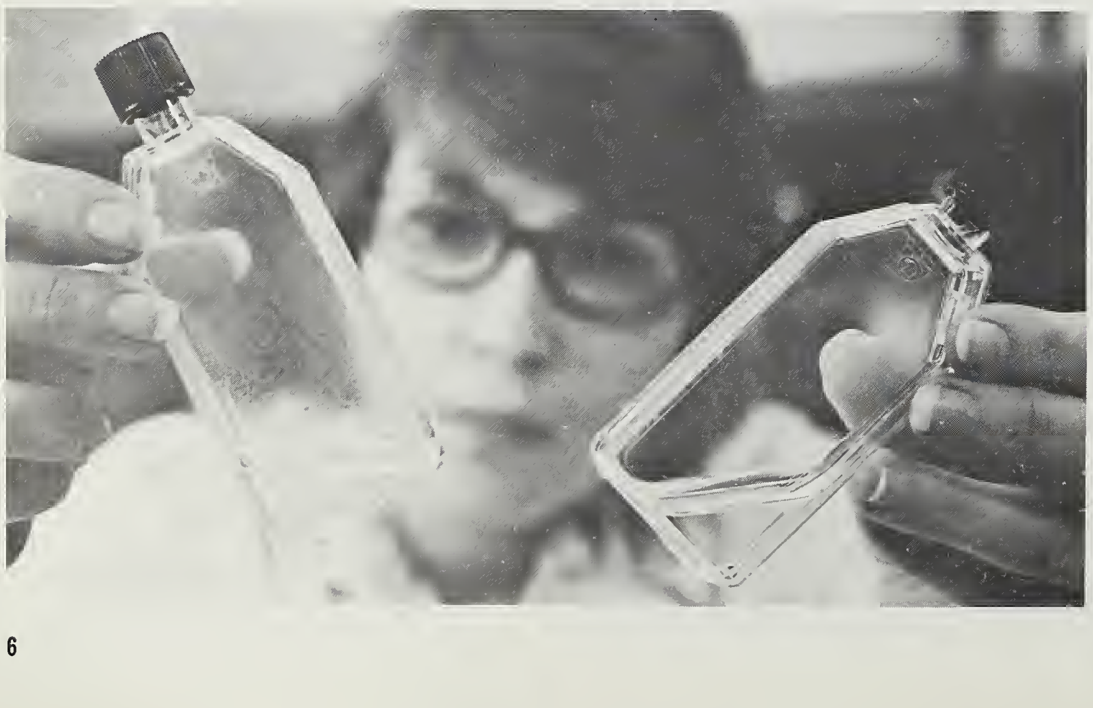
Tissue culture is the process or technique of growing living tissues and cells artificially in special, sterile culture mediums.

Entomologist Patrick V. Vail and technician Dixie L. Jay, of the Western Cotton Research Laboratory in Phoenix, Ariz., in cooperation with entomologist W. Fred Hink of Ohio State University, Columbus, are successfully growing nuclear polyhedrosis virus (NPV) in a tissue culture cell line of the cabbage looper. The virus was isolated from the alfalfa looper and introduced to the cell line growing in flasks. The insect cell line was established from ovarian tissue of a virgin adult cabbage looper and has been cultured for 4 years.

Nuclear polyhedrosis virus causes a disease that is fatal to many types of Lepidoptera—butterflies and moths—and has been used as part of a program of insect suppression in cotton fields and on a wide variety of vegetable crops. Among the many insects infected by the virus are the pink bollworm, cabbage looper, tobacco budworm, beet armyworm, alfalfa looper, celery looper, and saltmarsh caterpillar.

Presently, in order to grow the virus, scientists mass rear cabbage loopers, expose them to the virus, harvest them when they succumb to the disease, and process the virus into a powder. The powder is dusted on crops or is suspended in water and sprayed on fields where insects become infected by ingesting the virus along with their regular food supply. The rapidly multiplying viruses take over a insect's cells, disintegrate them, and just about liquefy the insect.

Once a virus infects the cells of its



*Laboratory technician Caryl Romine examines two solutions of the tissue culture. The culture on the left is 7 days old. When the culture becomes opaque, the cell lines need to be transferred to new culture medium (right) or they will die (0347X285–12).*

host insect, the cells produce virus instead of carrying on their normal pursuits. During this process, virus particles cluster under a protective coating of protein and form a many-sided body called a polyhedron, which is tough and durable and can live in the soil for years. Polyhedra are produced in tissue culture in much the same way.

Under optimum conditions, infected insects die within 3 days. The bodies harbor the virus that may infect other insects eating the surface contaminated by the diseased larvae.

Successful rearing of the virus in tissue culture is not the unique aspect of the Phoenix studies. Other scientists have grown viruses in tissue cultures, but not in the numbers (approximately 65 polyhedra per cell) that were found at Phoenix. The large numbers of polyhedra per cell makes these studies somewhat different.

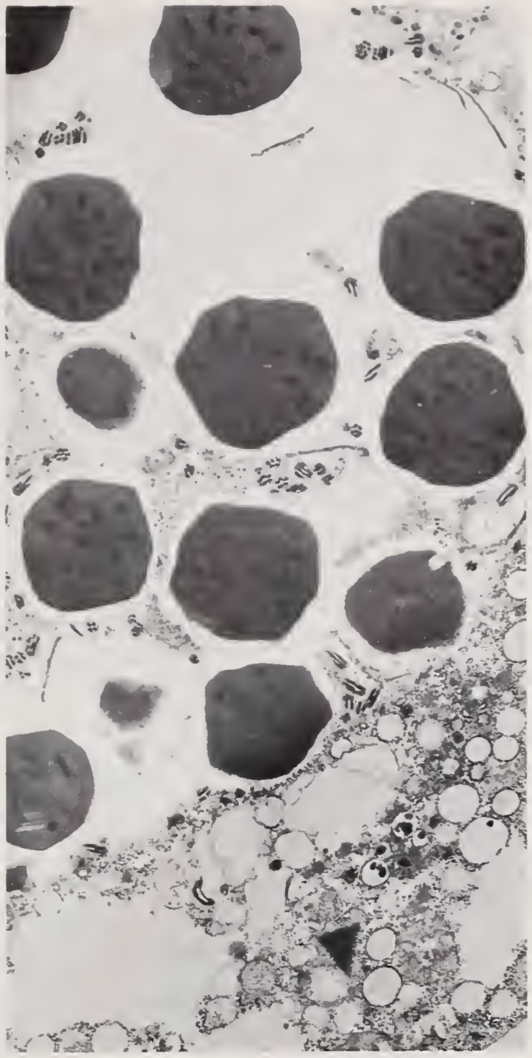
The Phoenix studies also are the first to show that viruses grown in tissue culture are equally as lethal, both qualitatively and quantitatively, as those grown by mass rearing procedures.

Advantages of using cell culture for producing viruses at this time are somewhat negated because of the cost of production.

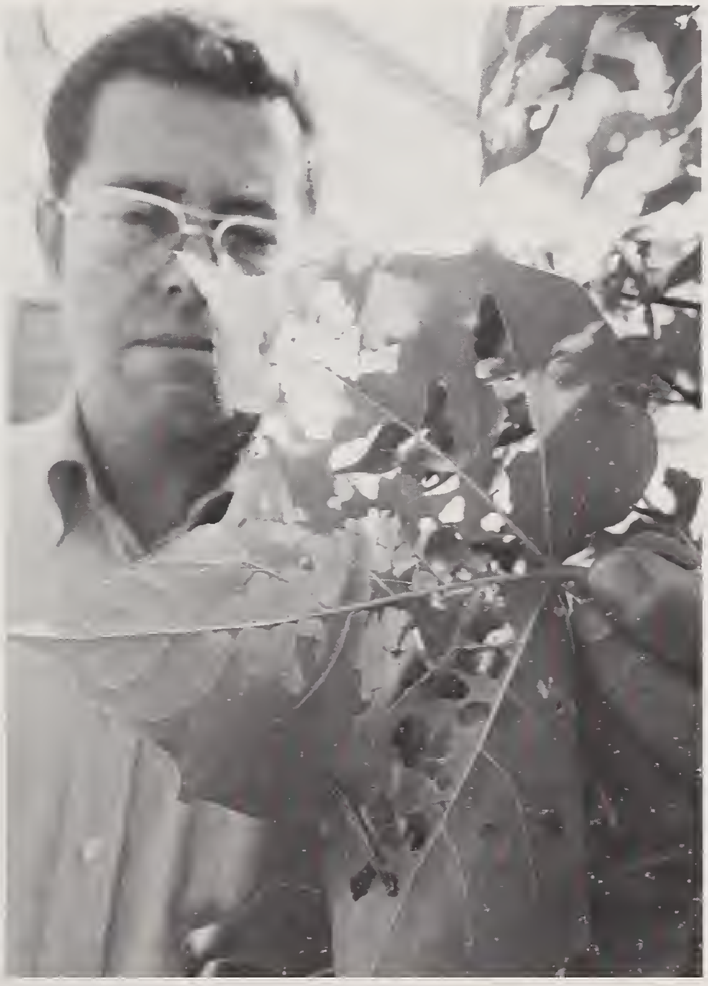
However, the high rate of cell infection achieved by Dr. Vail's group and the number of polyhedra containing virus produced per cell may motivate further investigation of tissue culture production of this virus.

"By adjusting the time of innoculation when cells are most active, innoculating when cell populations are high, and introducing virus when the division and metabolism of the cell line is most favorable, the yields of polyhedra might be greatly increased and the cost of production drastically reduced," Dr. Vail said.

"Moreover," he added, "we would benefit from the great advantage arising from the absence of microbial contaminants and would not need to depend on the tedious production of large numbers of host insects." □



*Above: Once the NPV is grown and isolated, it can be dusted or sprayed onto crops where insects, like the tobacco budworm here, become infected by ingesting the virus with their regular food. Infected insects die within 3 days. Their bodies harbor the virus and may infect other insects eating on the same plant (0347X283–13).* ***Left:*** *This greatly enlarged electron-micrograph shows the polyhedra in an infected cell nucleaus in the tissue culture (0374X288–25).* ***Below left:*** *Dr. Vail looks over the damage done by the cabbage looper larvae after a 4-day control experiment. Scientists at Phoenix are using the cabbage looper cell lines to grow nuclear polyhedrosis virus (NPV) in laboratory tissue cultures (0374X280–11).*



# Instant Fat Tester Goes to Market

ACCURATE SCALES in the supermarket or butcher shop assure the housewife buying a pound of ground beef that she is getting 16 ounces, but heretofore there had been no way for her to know precisely how many of these ounces consist of fat.

Determining accurately the percentage of fat in a meat sample takes time. Hours are required for the standard laboratory extraction procedure. Even the portable devices used by meat inspectors to estimate fat content take 15 to 30 minutes. Hence how much or how little fat is in a package of ground beef, within the legal 30-percent limit, is generally up to the judgment and integrity of the butcher.

All this may change as a result of ARS research on electronic methods of determining food quality. Already commercial devices based on this research are becoming available that reveal the percentage of fat in a sample of ground beef as quickly and simply as a scale reveals its weight. One company has a number of such instruments out on test, another is making a prototype unit, and several others are considering the development.

Inventors of the new "AMRI Ground Meat Analyzer" are electronic technician George F. Button, Jr., and engineer Karl H. Norris, of the ARS Agricultural Marketing Research Institute (AMRI) at Beltsville, Md. In cooperation with AMRI food technologist Anthony Kotula, they designed the device for ground beef and are now adapting it to other meats, including pork, lamb, and chicken. A public-service patent has been applied for.

In use, the portable instrument is simply placed on top of a package of ground beef. Even if the meat is wrapped in plastic, the amount of fat present is immediately indicated on a scale that records from 0 to 50 percent. With the commercial model, now under test, the meat is placed on top of the instrument.

The fat tester operates on the same principle as Mr. Norris' grain analyzer (AGR. RES., May 1973, p. 5). An electro-optical system measures the reflectance of the sample in the near-infrared portion of the spectrum. The reflectance curve for meat shows two dips in the 850 to 1050 nm (nanometers, or billionths of a meter) region, one at 970 nm produced by the water, and another at 928 nm produced by the fat. Since these two components in fresh meat bear an inverse relationship to each other, a highly accurate measure of the fat in a sample is provided by measuring the shape of the curve in the 930 to 950 nm region.

In the device developed by Mr. Button and Mr. Norris, four flashlight lamps are mounted in a tube to illuminate the meat sample. The reflected radiation is collected by an optical scanning system that incorporates a vibrating mirror and interference filter, coupled to a silicon solar cell. The output from the solar cell is amplified and sorted into two measuring signals, one representing the average reflectance of the sample and the other the change in reflectance noted by the scanner between

*Above: This bank of sophisticated electronic and optical equipment is called a spectrophotometer and was used to develop the principle of measurement employed in the prototype fat analyzer. Mr. Norris and Mr. Button are shown analyzing a meat sample (274A197–11).*

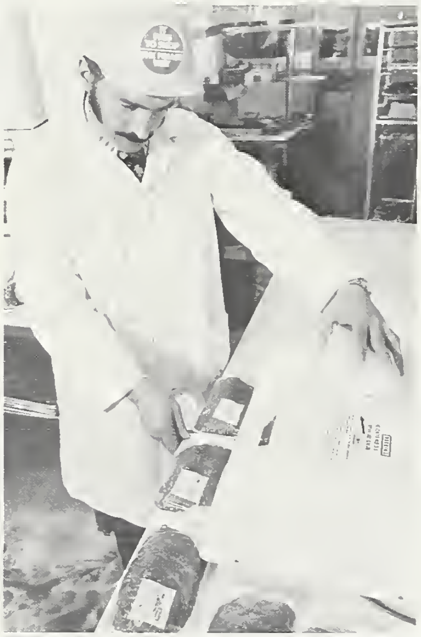
930 and 950 nm. A solid-state computer circuit then processes the two signals to produce appropriate needle deflection on a meter calibrated directly in percent fat.

In recent lab tests, ground beef samples with a range of fat content from 10 to 35 percent were analyzed by standard extraction procedures, then measured with the electronic fat tester. Both methods of determination agreed within a standard error of 1 percent. The fat tester's light rays penetrate only a few millimeters into the sample. Thus it is important that the meat and fat be thoroughly blended, as they usually are in the normal procedures used in preparing ground beef.

Adaptation of this device to a wide variety of meats and meat products should benefit retailers and consumers alike by permitting consideration of an important aspect of quality in arriving at a fair market value. □

*Electronic technician George F. Button and Mr. Norris discuss their ground meat analyzer (0274A195–31).*

*Below: This commercially manufactured fat analyzer is under test for customer acceptance by the First National Stores of Boston, Mass. Customer places ground meat on the sensor and reads the percentage of fat on a meter calibrated in percent fat (0374K253–27A).*



*Identical fat analyzers were installed in the supermarket meat-cutting room for use by meat cutters in testing samples of ground beef. A First National Stores spokesman reports enthusiasm by meat cutters, management, and customers over the device based on ARS research (0374K255–3A).*


*The commercial fat analyzer features simple and easily understood operating instructions (0374K254–15).*

# They Pass The Flame Test

FROM crib to kindergarten, children wearing sleeping apparel suffer injuries from burns four times more frequently than do people in other age groups. Consumers look for a radical improvement in these statistics. Federal regulations setting the flammability standards of fabrics used in pajamas, robes, and nightgowns for infants and children up to size 6X are much stricter.

Sleepwear must now pass a vertical flame test after 50 launderings at 140° F. with a high phosphate detergent formulated by the American Association of Textile Chemists and Colorists (AATCC).

Briefly, this is the test method. Five conditioned 3½ by 10 inch samples taken from a garment are suspended one at a time vertically in holders in a prescribed cabinet. They are then subjected to a standard flame along their bottom edge for a specified time under controlled conditions. The average char length of the five samples must not exceed 7 inches. No more than one sample may show a char length of 10 inches. No individual sample should have a residual flame time greater than 10 seconds.

Current studies by chemists at the ARS Textiles and Clothing Laboratory in Knoxville, Tenn., are concerned with the interactions of the flame retardant finish, cotton fabric, and common household soils. What, for example, is the effect on flame retardant fabrics of repeated soiling with milk? Does the subsequent laundering harm the protective finish? How is the durability of the fabric itself affected?

Research by ARS chemists Austin L. Bullock and Mary E. Carter was based on selected flame retardant cotton flannelette fabrics. The 100 percent cotton fabrics were studied using methods described by the AATCC and the American Society for Testing and Material (ASTM) to determine: (1) durability of the flame resistant finish (2) strength retention, and (3) resistance to abrasion.

Along with one untreated sample, eight different test fabrics treated for flame retardancy by a formula or a modified formula based on organic phosphorus and nitrogen compounds were used in the study. Both milk-soiled and non-soiled samples were subjected to 50 standard laundry cycles by an AATCC method and to a similar soil-dry-laundry-dry procedure repeated for 50 cycles. Samples were analyzed at regular intervals. When the fire retardant-treated cotton fabrics showed only borderline resistance, the fabric was adversely affected by soiling with milk. "We concluded," said Mr. Bullock, "that in general, if the unsoiled fabric passes the flame test, the soiled fabrics also will pass."

Because nitrogen heightens the flame resistance contributed by phosphorus,

*Left:* Chemist Austin L. Bullock observes the burning rate of laundered flame-retardant (left) and untreated sleepwear samples (0374X267–3A). *Below:* Technician Joanne Chesley counts the number of threads per square inch on a sample of flame-retardant sleepwear fabric. The thread count is made after each soil-launder cycle to determine the influence of shrinking on the fabric (0174X94–15).

nitrogen loss was evaluated. Analysis showed slight loss for some fabrics, but was not significant for most. A slightly greater loss occurred with soiled samples than for corresponding unsoiled samples.

The effect of soiling with milk was more noticeable on the textile properties of the fabrics than on the retardant finish. Both tearing strength and abrasion resistance of soiled samples were improved. A grease-like material, recovered when laundered fabric samples were extracted, appeared to be glycerides or fatty acids. "Such materials," Dr. Carter said, "often exhibit a softening or lubricating effect on textile materials." □

*Above:* Washability of flame-retardant fabric is described by Mary E. Carter. Dr. Carter is presently director of ARS's Southern Regional Research Center at New Orleans, La. (0474X400–9). *Below:* Differences in the flame-retardant durability of various finishes are demonstrated here. Each of the four samples was subjected to 50 soil-launder cycles, then flame tested (0174X94–23).

# A SUPER COLONY

*Earth from the multiple-queen mound reveals the fire ants as they scurry to protect their queens. Entomologist Clarence E. Stringer records their movements for study (0474X537–13).*

In an extraordinary discovery near Hurley, Miss., entomologists have reported a massive series of imported fire ant mounds which may constitute the largest single colony of multiple queens on record.

"From this highly atypical and intriguing example of polygyny," says ARS entomolgist B. Michael Glancey, "we were able to collect over 10,000 mated females for laboratory analysis, all of which were functioning queens."

In repeated samplings, researchers removed shovelfuls of soil from the top of random mounds and scattered them over a nearby paved road. When the fire ant workers rushed to protect the dealated females (female ants dealate, or drop their wings after mating), the females were collected and returned to the Imported Fire Ant Research Laboratory in Gulfport, Miss. Over 300 females were dissected to determine insemination, and each of 318 others were placed in petri dishes containing moist cotton along with 25 of their workers. All 318 oviposited and reared the brood to the worker stage.

Four experiments at the mound site led researchers to conclude that all of the queens were related and that the series of mounds was actually one large colony of multiple-queen imported red fire ants, *Solenopsis invicta*, Buren.

(1) Feeding stations consisting of bottle caps containing soybean oil and red dye were placed in the middle and at each end of the ditch bank. After one week, samples from 10 mounds selected at random were collected and returned to the laboratory for examination. Red dye was found in the crops of ants from all 10 samples.

(2) Although laboratory colonies of imported fire ants do not tolerate more than one queen, and more than one queen is very rare in nests found in fields, as many as 50 queens survived in individual nests stocked from a nearby dump area.

(3) Researchers removed shovelfuls of ants from one mound to another

mound, observing no hostile or aggressive behavior between workers of different colonies.

(4) Researchers observed peaceful crossing of forage trails from different mounds, as opposed to the characteristic delineation of foraging territories among imported fire ants. Normally, foraging fire ants do not mingle.

What the multiple-queen colony means to the eventual control and possible elimination of the insect is the subject of continuing investigation by Dr. Glancey, research entomologist Clarence E. Stringer, research technician Charles H. Craig, and field technician Paul M. Bishop at the Gulfport station.

"It could once again be a time of evolutionary change that will cause the colonies to disappear," said Dr. Glancey. "Without enough workers to feed her, the queen and her brood will starve. In New Orleans in the 1940's the Argentine ant was epidemic. It, too, was winged and polygenous. Suddenly it began to disappear, almost as dramatically as it spread."

The imported fire ant is a winged, fiercely stinging omniverous ant, a mound-building species which is now almost cosmopolitan in warm regions. Accidentally introduced from South America and first observed in Mobile, Ala., in 1920, it has spread explosively throughout the South, with the heaviest geographical infestation in the southeastern States. Its impact is not only on agriculture and human health, but on dollars and cents in the farmer's pocketbook.

Over 157 million acres in the United States are infested with the imported fire ant, often 50 mounds to an acre. Two to 3-feet high, these mounds interfere with plowing and harvesting, and pose a problem for labor working in infested fields. Crops also suffer. Fire ants can damage a number of crops, including soybean plants, citrus trees, strawberry plants, seed potatoes, young cabbage, and sorghum plants. They attack the offspring of poultry and livestock. In humans their bites cause lesions which are easily infected. The American Medical Association cited the imported fire ant as a health hazard "contributing to morbidity and mortality" (resolution 38, at its 1971 annual meeting).

The fire ant's life cycle includes programed travel plans, 3 to 5 miles during each mating flight. Adult winged males and winged females emerge from a mature mound, built of dirt and honeycombed with tunnels, in early and midsummer. After mating high in the air, the male dies, having served his only function, and the female drifts or flies until she burrows into the earth to lay

*Above: Firmly held by tweezers, this female fire ant collected at the multiple-queen colony will be taken to the laboratory for analysis (0474X537–23). Left: In collecting fire ants, shovelfuls of soil from mounds are thrown onto an adjacent road. The queens are easily identified by their larger bodies and by the activity of workers rushing to their aid. Even so—deft fingers, sharp eyes, and agility are needed to catch the queens and avoid stings by the angered worker ants (0474X535–15A).*

her eggs. Within 5 or 6 weeks the first workers pierce the walls of the nest and take on the task of foraging. The queen then becomes solely an egg-laying machine, fed, groomed, and guarded by the sexless workers. In a year the colony may have up to 100,000 workers and will produce sexual forms, winged males and females ready to repeat the cycle.

Is it possible to eliminate the fire ant?

"Control may be a better word," said Dr. Glancey. "Methods have varied. If you burn the mounds, workers simply carry off the queen through escape tunnels and start all over again. We can apply insecticides locally and by aerial spraying of the fields. Various baits have been used over the years to poison the workers, but the bait must reach the queen. Any effective, delayed-action bait—mirex is one—can trigger the extinction of a colony if it reaches her deep inside the mound."

Researchers recognize a formidable enemy in the imported red fire ant. Her ancestors have lived on earth over 50 million years. Man? He's just 49 million years behind. □

***Right:** Feeding stations—bottle caps filled with soybean oil and red dye—are placed on a mound at the multiple-queen site by research technician Charles H. Craig (0474X536-11).*

***Below:** Entomologist B. Michael Glancey probes an exit tunnel in a fire ant forage trail to determine the kinds of food the insects are carrying away (0474X535-7A).*

## SCIENTISTS HONORED

***For their outstanding achievements, eight individuals and two groups of ARS employees recently received Distinguished and Superior Service Awards. Secretary of Agriculture Earl L. Butz presented the awards at USDA's 28th annual awards ceremony last May 16 in Washington, D.C.***

### *Distinguished Service:*

**Kenneth L. Lebsock,** Assistant Area Director, St. Paul, Minn., for developing improved varieties of spring wheat, especially durum wheat varieties, that have had a tremendous impact on the pasta industry in the United States.

**Jordan H. Levin,** research leader and location leader, East Lansing, Mich., for research and leadership in revolutionizing the harvesting and handling of fruits and vegetables through the development of sophisticated machines and systems.

**Bernice K. Watt,** research leader, Hyattsville, Md., for developing food composition tables which are recognized worldwide as standard references essential to the conduct of many health and welfare programs and to research in nutrition.

*Research leader Bernice K. Watt (0574A588-15).*

### *Superior Service:*

**Anaplasmosis Research Team,** Beltsville, Md., for cooperative research culminating in the development of a rapid, practical and reliable test for the diagnosis of bovine anaplasmosis. Headed by Thomas O. Roby, team members also include: Thomas E. Amerault, Edward A. Schilf of APHIS, Joseph E. Rose, and Richard L. Sealock.

**Pesticide Degradation Laboratory,** Beltsville, Md., for research on the occurrence and fate of a highly toxic pesticide contaminant, TCDD, and its significance to man and his environment. Headed by Philip C. Kearney, other team members include: George F. Fries, Charles S. Helling, Allan R. Isensee, Gerald E. Jones, Ute I. Klingebiel, George S. Marrow, Jr., Jack R. Plimmer and Edwin A. Woolson.

**Vernon P. Moore,** Director, U.S. Cotton Ginning Laboratory, Stoneville, Miss., for developing, directing, and executing a ginning research program that has greatly improved the quality and lowered the cost of cotton fiber in the United States.

**Robert E. Enlow,** Regional Information Officer, Peoria, Ill., for leadership in establishing effective regional outlets for research information, and for developing innovative methods of communicating research results to agricultural, industrial, and consumer news media.

**Dorothy E. Harnish,** secretary to the Administrator, Washington, D.C., for executive secretarial support to the Administrator during the major reorganization of ARS.

*Assistant Area Director Kenneth L. Lebsock (BN-42131).*

**Robert Thomas Ramage,** research geneticist, Tucson, Ariz., for basic research on the cytogenetics of barley which led to the first successful commercial hybrid among the small grains, and for creative development of barley breeding methods.

**Edwin P. Lloyd,** research entomologist, Mississippi State, Miss., for directing a multiagency effort in conducting the Pilot Boll Weevil Eradication Experiment to culminate the elimination of the boll weevil as an economic cotton pest from the United States (Joint award with F. J. Boyd, entomologist, APHIS). □

*Right: research leader Jordan H. Levin (0574X599-6).*

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## Pneumatic track outperforms tire

AN EXPERIMENTAL pneumatic track for farm equipment performs better than a pneumatic tire and almost as well as a steel track.

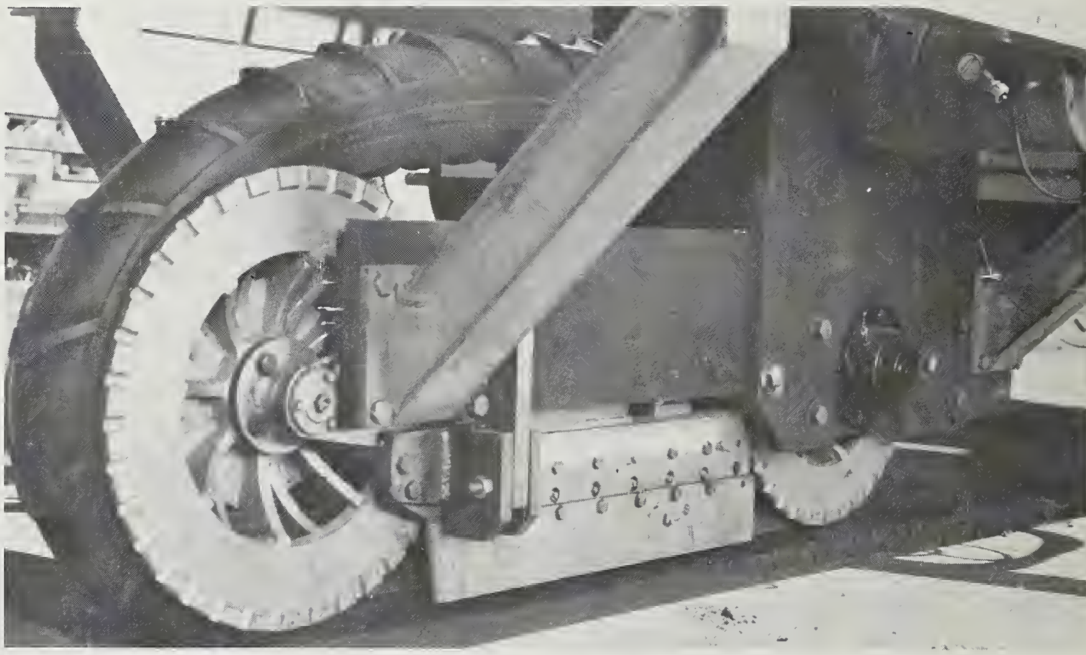
The pneumatic track, which is of Italian origin, was tested by agricultural engineers James H. Taylor and Eddie C. Burt of the National Tillage Machinery Laboratory at Auburn, Ala. It performed on a nearly equal basis with the steel track in two tests and outperformed the steel track and pneumatic tire in soil pressure tests.

Dr. Taylor said the pneumatic track has potential for high-speed use in the field and on hard-surfaced roads. In the past, steel tracks proved superior to pneumatic tires in traction; their use, however, was restricted because of slow speed, rough ride, high initial and maintenance costs, and their prohibition on hard-surface roads.

Both types of tracks outperformed the pneumatic tire in tests of dynamic traction ratio (pull/weight) and tractive efficiency on wet and dry Norfolk Sandy Loam and Decatur Clay Loam soils.

The pneumatic track, however, outperformed both the steel track and the pneumatic tire in soil pressure tests. The total soil contact area was identical for the pneumatic tire and the pneumatic track. The long, narrow ground contact area of the track offers two distinct advantages toward solving two problems that increasingly concern many farmers. The track disturbs a smaller area of soil on each pass through the field, and the soil pressures and bulk densities are lower, Dr. Taylor said. Pressure measurements were made at a depth of 20 centimeters under each contact area.

"The disadvantages of tracks for today's typical farm application are many and real," Dr. Taylor said. "However, their field traction performance is so superior that the track concept cannot be relegated to the junk heap. The pneumatic track concept has the potential for combining many of the desirable features of pneumatic tires, resulting in a traction device superior to anything now available."



*Test frame at the National Tillage Machinery Laboratory, Auburn, Ala., holds pneumatic track. The track has a ground contact area of 6.3 inches by 55 inches and stands 4½-feet high (PN–2859).*

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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